

REMARKS

In the final Office action, independent claim 1 and claims 2-10 dependent therefrom, and independent claim 11 and claims 12-14 dependent therefrom were finally rejected under 35 U.S.C. 103(a) as being unpatentable over U.S. Patent No. 4, 963, 012, Tracy et al., in view of U.S. Patent No. 5, 650, 353, Yoshizawa et al. Applicant respectfully traverses the rejection of claims 1-14 and offers the following remarks in support of this position.

INDEPENDENT CLAIM 1

Claim 1 (original): A macroscopic mirror for wide angle scanning applications comprising:

a silicon substrate section of a predetermined shape and macroscopic size cut from a silicon wafer comprising a flat, polished surface side and an etched, rough surface side; and

a plurality of layers, including a layer of reflective medium, disposed on the flat, polished surface of said substrate section in such a manner to minimize flexural distortion of said flat surface.

THE EXAMINER'S POSITION REGARDING CLAIM 1

“Tracy et al. discloses a macroscopic mirror (Fig. 8) comprising:

a silicon substrate (132) of a predetermined shape and macroscopic [size]cut (inherent see Fig. 7) from a silicon wafer;

a plurality of layers (134, 136) including a layer of reflective medium (136) disposed on the silicon substrate in a manner to minimize flexural distortion of the surface (see col. 8, lines 65-68)”

“Tracy et al. does not disclose the silicon substrate that comprises a flat polished surface and an etched rough surface.

Yoshizawa et al discloses a silicon substrate that comprise a flat polished surface and an etched rough surface (see col. 4, lines 15-15) and the substrate section is cut from the silicon wafer (see column 5). It would have been obvious to one of ordinary skill in the art to use the

technique of etching and polishing the silicon wafer before cut as taught by Yoshizawa et al for the purpose of increasing bonding between the layers while maintaining strong grips between layers using the etched and polished surfaces.”

THE APPLICANT’S POSITION REGARDING CLAIM 1

The silicon dioxide (SiO₂) layer 132 of the heliostat 108 of Tracy et al. is not the substrate thereof. Rather, the substrate 130 is a thin flexible metallic sheet, such as rolled stainless steel or aluminum or copper foil (see col. 3, lines 57-65 and col. 8, lines 46-48).

The SiO₂ layer 132 is not cut from a silicon wafer (i.e. a silicon wafer section). Rather, the SiO₂ layer 132 is coated on the surface of the metallic layer 130 to planarize the surface (col. 8, 22-29 and same col., lines 48-51). The planarization of the surface of the metallic substrate 130 is performed because the rough surface thereof can not achieve the reflectance requirement desired and needed for the mirror application (see col. 7, lines 36-53). To planarize the surface, the metal foil substrate 130 is dipped into sol-gel, air dried and then heated to boil out the solvent which leaves a thin layer of SiO₂ 132 on the surface of the metallic substrate 130 (see col. 8, lines 3-9).

The assertion that the technique of etching and polishing the silicon wafer before cut taught by Yoshizawa et al. for the purpose of increasing bonding between the layers while maintaining strong grips between layers using the etched and polished surfaces may be used in Tracy et al. is not relevant because there is no teaching or suggestion in Tracy et al. of a silicon substrate of macroscopic size cut from a silicon wafer (i.e. a silicon wafer section) as noted above. Even if the references were able to be combined as proposed by the examiner, the technique of etching and polishing of Yoshizawa et al. could only be used on the coated layer 132 of SiO₂ of Tracy et al., albeit it is not clear whether this is even possible. The resultant structure would not render claim 1 obvious. Note also that the silicon substrates of Yoshigawa et al. are not of a macroscopic size, but rather of miniature sizes used for semiconductor substrates.

For at least these reasons, independent claim 1 is patentably distinguishable over Tracy et al. and Yoshizawa et al., either taken individually or in combination.

DEPENDENT CLAIM 2

Claim 2 (original): The macroscopic mirror of claim 1 wherein the reflective medium being selected for an at least one wavelength of radiation to be reflected thereby.

THE EXAMINER'S POSITION REGARDING CLAIM 2

“the reflective medium being selected for an at least one wavelength of radiation to be reflected thereby (inherent [Tracy]136 is silver);”

THE APPLICANT'S POSITION REGARDING CLAIM 2

Applicant takes the position that claim 2 is patentably distinguishable over the cited prior art for the same reasons given for the parent claim 1 given above.

DEPENDENT CLAIM 3

Claim 3 (original): The macroscopic mirror of claim 1 wherein the reflective medium is selected from the group consisting of gold and silver.

THE EXAMINER'S POSITION REGARDING CLAIM 3

No position explicitly stated.

THE APPLICANT'S POSITION REGARDING CLAIM 3

Applicant takes the position that claim 3 is patentably distinguishable over the cited prior art for the same reasons given for the parent claim 1 given above.

DEPENDENT CLAIM 4

Claim 4 (original): The macroscopic mirror of claim 1 wherein the etched, rough surface side of the silicon substrate serves as a backing plate for bonding the mirror to a scan drive mechanism.

THE EXAMINER'S POSITION REGARDING CLAIM 4

“a side of the silicon substrate serves as a backing plate for bonding the mirror to a scan drive mechanism (see [Tracy] column 1, lines 61-65)”

THE APPLICANT'S POSITION REGARDING CLAIM 4

The citation of Tracy col. 1, lines 61-65 is directed to substrates of flexible rolled metal, and not to silicon substrates as implied. The substrate 130 of Tracy et al. is not a silicon substrate cut from a silicon wafer as noted above and the side of the substrate 130 which bonds the heliostat 108 to the supporting structure 112, 116 is not an etched, rough surface. Thus, Applicant takes the position that claim 4 is patentably distinguishable over the cited prior art for these reasons and for the same reasons given for the parent claim 1 given above.

DEPENDENT CLAIM 5

Claim 5 (original): The macroscopic mirror of claim 1 wherein the plurality of layers comprise a bottom primer layer, a middle reflective medium layer and a top protective coating layer.

THE EXAMINER'S POSITION REGARDING CLAIM 5

“the plurality of layers are a bottom prime layer (130), a middle reflective layer (136) and a top protective coating layer (Fig. 9, 138 and col. 9, lines 1-5);”

THE APPLICANT'S POSITION REGARDING CLAIM 5

Claim 1 recites “a plurality of layers, including a layer of reflective medium, disposed on the flat, polished surface of said substrate section” which is a limitation that is included in dependent claim 5. For the sake of argument, if the silicon substrate of Tracy et al. is the layer 132 as asserted by the examiner, then layer 130 can not be the bottom prime layer of the plurality as recited by dependent claim 5 because it is not disposed on the asserted substrate layer 132 as recited by claim 1. Actually, Tracy et al. do not teach or suggest a silicon substrate cut from a silicon wafer as noted above, and therefore, the plurality of layers 134, 136 and 138 taught by Tracy et al. are not disposed on a silicon wafer section substrate. Applicant takes the position that

claim 5 is patentably distinguishable over the cited prior art for these reasons and for the same reasons given for the parent claim 1 given above.

DEPENDENT CLAIM 6

Claim 6 (original): The macroscopic mirror of claim 5 wherein each layer of the plurality of layers is applied by sputtering to a predetermined thickness.

THE EXAMINER'S POSITION REGARDING CLAIM 6

“each layer of the plurality is sputtered to a predetermined thickness (see [Tracy] Fig. 9);”

THE APPLICANT'S POSITION REGARDING CLAIM 6

The examiner's reference to Fig. 9 and the associated text of Tracy et al. is not dispositive of the obviousness issue regarding claim 6. Tracy et al. merely describe depositing the layers 134, 136 and 138 in the specification at the bottom of col. 8 and top of col. 9 where Fig. 9 is described and do not teach or suggest sputtering the layers to a predetermined thickness.

Applicant takes the position that claim 6 is patentably distinguishable over the cited prior art for these reasons as well as for the same reasons given for the parent claim 1 given above.

DEPENDENT CLAIMS 7-9

Claim 7 (original): The macroscopic mirror of claim 1 wherein the mirror has a thermal distortion coefficient in the range of 0.020 to 0.032.

Claim 8 (original): The macroscopic mirror of claim 1 wherein the substrate section is cut from the wafer in the form of an ellipse having a major axis dimension of approximately 70 mm and a minor axis dimension of approximately 50 mm.

Claim 9 (original): The macroscopic mirror of claim 1 wherein the silicon wafer from which the substrate section is cut has a thickness of less than 1 mm.

THE EXAMINER'S POSITION REGARDING CLAIMS 7-9

“Tracy et al. in view of Toshizawa et al. discloses the claimed invention as set forth above except that the dimensions of thermal distortion coefficient, thickness or dimension of the silicon substrate. It would have been obvious to one of ordinary skill in the art to choose these dimensions since it has been held that discovering an optimum values only involves routine skill in the art.”

THE APPLICANT'S POSITION REGARDING CLAIMS 7-9

It has been shown above that Tracy et al. in view of Yoshizawa et al. do not disclose the claimed invention of claim 1 from which claims 7-9 are dependent. Thus, Applicant takes the position that claims 7-9 are patentably distinguishable over the cited prior art for the same reasons given for the parent claim 1 given above.

In addition, the position taken by the examiner regarding claims 7-9 appears to be a statement of conclusion without evidentiary support from the references. If the examiner desires to maintain this rejection, Applicant respectfully requests that some evidentiary authority and/or reference be produced in support of the examiner's position. Otherwise, dependent claims are patentably distinguishable over the cited references in their own right.

DEPENDENT CLAIM 10

Claim 10 (original): The macroscopic mirror of claim 1 wherein the substrate section is laser cut from the silicon wafer.

THE EXAMINER'S POSITION REGARDING CLAIM 10

No position explicitly set forth.

THE APPLICANT'S POSITION REGARDING CLAIM 10

As noted above, neither Tracy et al. nor Yoshizawa et al. teach or suggest a silicon substrate of a heliostat cut from a silicon wafer. Thus, neither Tracy nor Yoshizawa teach or suggest a silicon wafer that is laser cut from a silicon wafer. Thus, Applicant takes the position

that claim 10 is patentably distinguishable over the cited prior art for these reasons as well as for the same reasons given for the parent claim 1 given above.

INDEPENDENT CLAIM 11 AND CLAIMS 12-14 DEPENDENT THEREFROM

Claim 11 (original): A method of making a macroscopic mirror for wide angle scanning applications comprising:

preparing a silicon wafer by polishing one side to a predetermined flatness and etching the other side to a predetermined roughness;

cutting a substrate section from the prepared silicon wafer to a predetermined shape and macroscopic size; and

applying a plurality of layers, including a layer of reflective medium, on the flat, polished surface of said substrate section in such a manner to minimize flexural distortion of said flat surface.

Claim 12 (original): The method of claim 11 wherein the substrate section is cut from the silicon wafer in a cookie cutter fashion.

Claim 13 (original): The method of claim 11 wherein the substrate section is laser cut from the silicon wafer.

Claim 14 (original): The method of claim 11 wherein the step of applying includes the steps of:

applying a primer layer to a first predetermined thickness on the flat, polished surface of the substrate section;

applying the reflective medium layer to a second predetermined thickness on the primer layer; and

applying a protective coating layer to a third predetermined thickness on the reflective medium layer.

THE EXAMINER'S POSITION REGARDING CLAIMS 11-14

“The method of making the mirror is inherently met by the disclosure of the prior art.”

THE APPLICANT'S POSITION REGARDING CLAIMS 11-14

The disclosure set forth in the references Tracy et al and Yoshizawa et al do not inherently meet the method of making a macroscopic mirror as recited in claims 11-14 above. More specifically, it has been shown that neither Tracy nor Yoshizawa teach or suggest “cutting a substrate section from the prepared silicon wafer to a predetermined shape and macroscopic size;” for a macroscopic mirror. In addition, neither Tracy nor Yoshizawa teach or suggest that a substrate section for a macroscopic mirror is cut from the silicon wafer in a cookie cutter fashion (claim 12) or is laser cut from the silicon wafer (claim 13). Also, since no silicon substrate of macroscopic size cut from a silicon wafer is taught or suggested from the prior art, then the steps of applying the primer, reflective medium and protective coating layers on the silicon substrate (claim 14) are not met by the prior art. Accordingly, claims 11-14 are patentably distinguishable over the references of Tracy et al and Yoshizawa et al. for at least these reasons.

THE COMBINATION OF REFERENCES IS IMPROPER

THE EXAMINER'S POSITION

“In response to applicant's argument that the examiner's conclusion of obviousness is based on improper hindsight reasoning, it must be recognized that any judgment on obviousness is in a sense necessarily a reconstruction based upon hindsight reasoning. But so long as it takes into account only knowledge which was within the level of ordinary skill at the time the claimed invention was made, and does not include knowledge gleaned only from the applicant's disclosure, such a reconstruction is proper.”

THE APPLICANT'S POSITION

Tracy et al. show a heliostat structure equipped with a mirror surface constructed on a metal foil substrate in Figure 7, and an enlarged cross-sectional view of the mirror structure having a metal foil substrate 130 planarized with SiO₂ 132 and having a silver 136, SiO₂ interface passivated with a silver nitride layer 134 in Figure 8 according to the invention (see col.

3, lines 57-65). For a more detailed description of Figure 7 refer to col. 8, starting at line 33, and of Figure 8, refer to col. 9, starting at line 43. From the text of column 8, it is clear that the substrate of the mirror structure of Figure 7 is a thin, flexible metallic sheet 130 such as rolled stainless steel, aluminum or copper foil (lines 46-48) and the surface of the metallic layer 130 is coated with a glassy SiO₂ layer 132 by a sol-gel process for coating (lines 49-50). Mirror substrates of polymer plastic sheets are shown in Figures 10 and 12.

Yoshizawa et al. is directed to a method for producing silicon-on-insulator substrates for the semiconductor industry. The method comprises superposing and bonding at least three single crystal silicon wafers through a medium of SiO₂ film formed on each of the wafers (see Abstract). Yoshizawa et al. is directed primarily to semiconductor wafer technology (see col. 1, starting at line 16). None of Yoshizawa's processes are related to a mirror or the making thereof.

In contrast to these prior art techniques and products, independent claim 1 of the instant application recites a macroscopic mirror comprising a silicon substrate of a predetermined shape and macroscopic size cut from a silicon wafer, and independent claim 11 recites a method of making the same comprising cutting a substrate section from the prepared silicon wafer to a predetermined shape and macroscopic size. Neither Tracy et al. nor Yoshizawa et al., taken individually or in combination, teach or suggest a macroscopic mirror having a silicon wafer section substrate or the manufacture thereof as recited in claims 1 and 11. Rather, Tracy et al. teach a flexible, metal foil substrate coated with SiO₂ by a sol-gel process, and Yoshizawa et al. teach the bonding of at least three silicon wafers using a medium of SiO₂ for semiconductor substrates.

It is the examiner's position as noted above that Tracy et al. does not disclose the silicon substrate that comprises a flat polished surface and an etched rough surface, but Yoshizawa et al discloses a silicon substrate that comprise a flat polished surface and an etched rough surface (see col. 4, lines 15-15) and the substrate section is cut from the silicon wafer (see column 5). The examiner asserts that it would have been obvious to one of ordinary skill in the art to use the technique of etching and polishing the silicon wafer before cut as taught by Yoshizawa et al for the purpose of increasing bonding between the layers while maintaining strong grips between layers using the etched and polished surfaces.

The well established law requires that to combine references for an obviousness rejection under 35 U.S.C. 103(a), there must be a positive suggestion in one or the other of the references to motivate one to form the combination. Thus, “to use the technique of etching and polishing the silicon wafer before cut as taught by Yoshizawa et al for the purpose of increasing bonding between the layers while maintaining strong grips between layers using the etched and polished surfaces” in Tracy et al. as proposed by the examiner is improper since there is no teaching or suggestion of such a silicon wafer substrate in Tracy et al. Likewise, there is no teaching, suggestion or motivation in Yoshizawa et al. to use the silicon-on-insulator substrate as a substrate of a macroscopic mirror. The only suggestion and motivation of such a combination is in Applicant’s teaching of the instant application and it is impermissible to use Applicant’s own teachings to combine references.

The level of ordinary skill in the art at the time the invention was made may only be established by evidence, like the two references cited by the examiner. But, as noted above, the teaching and/or suggestion of Tracy et al. and Yoshizawa et al. themselves do not provide the necessary and sufficient level of ordinary skill to permit a combination thereof. They are not even in the same art area - Tracy et al. pertaining to the art of macroscopic mirrors and Yoshizawa et al. pertaining to miniature substrates for the semiconductor industry. Accordingly, unless the examiner can show the necessary and sufficient evidence of a level of ordinary skill which can permit a combination of the cited references free from the knowledge gleaned from the Applicant’s disclosure, then the cited combination is improper.

In view of the above, it is respectfully requested that the final rejection of the pending claims 1-14 be reconsidered and withdrawn and the instant application be considered in condition for allowance. Thus, it is respectfully solicited that the instant application be given an early issuance.

Respectfully submitted,



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